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PATENT APPLICATION

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Yashuhiro MIYAMOTO et al

For: GREASE COMPOSITION FOR BEARINGS  
OF INFORMATION DEVICES

Serial No.: 09/625 148

Group: 1764

Filed: July 25, 2000 Examiner: Howard

Atty. Docket No.: OPS Case 498

Assistant Commissioner for Patents

Washington, DC 20231

**DECLARATION UNDER 37 CFR front case 1.132**

I, Motoharu AKIYAMA, hereby declare as follows:

I am one of the co-inventors of the invention described and claimed in application Serial No. 09/625 148, filed on July 25, 2000.

I am employed by the Technical Development Patent Department of Minebea Co., Ltd., the assignee of the present application, and have had experience in the technical field of the present invention for twenty years.

I have carried out additional tests to illustrate the criticality of carbonate hydrocarbon residues being a branched alkyl group having from 13-15 carbon atoms.

During my investigation into grease compositions that are suitable for use with bearing for information equipment, the following observations were made: (1) The power consumption of a motor is minimized by reducing

the torque of a bearing; (2) A magnetic head and hard disc are not damaged; (3) Characteristics of a bearing are not changed; (4) Durability of a bearing; and (5) Respiration of a bearing.

With respect to (1), it was desired to render the viscosity of the grease composition as low as possible, reduce the torque of the bearing by reducing the amount of grease and improve the evaporation properties of the grease. With respect to (2), it was desired to develop a grease composition having a low outgas property. With respect to (3), it was desired to keep the grease composition constant to avoid damage to race faces and it was discovered that fretting characteristics are improved by molybdenum compounds having specific structures. With respect to (4), a load test was carried out for an extended period of time. With respect to (5), it was desired to develop a grease composition having low outgas properties for allowing less outgas by a non-contact seal. Carbonate compounds having branched alkyl residues having from 13 to 15 carbon atoms, when used in the inventive grease compositions, were found to satisfy the above five requirements.

Samples of a base oil (A, B, C and D) similar to those of U.S. Patent No. 2 739 127 to Morway et al were varied in alkyl group residues of a carbonate compound and grease compositions were prepared using lithium stearate as a thickener. The mixing ratio between the components of the base oil of Samples A, B, C and D and the thickener are shown in Table 1 below.

Table 1

Sample						Thickener
	Number of Carbon C=8	Number of Carbon C=10	Number of Carbon C=13	Number of Carbon C=16	Number of Carbon C=13-15	With respect to base oil Li-St (% by mass)
A	40	40	10	10	-	20
B	10	10	40	40	-	20
C	25	25	25	25	-	20
D	20	20	20	20	20	20
Present Invention	-	-	-	-	100	20

5 to 7 mg of the sample greases and the grease of the present invention were placed in a vessel and a purging and trap system test was performed at the temperature of 85°C and the amount of outgas generated per mg of grease was determined. The results are shown in Table 2.

Table 2

Sample	Amount of outgas ( $\mu$ g)	Ratio for present invention
A	17.205	2.76
B	13.126	2.10
C	13.501	2.16
C	14.291	2.29
Present Invention	6.241	1

## DISCUSSION OF RESULTS

As illustrated in Table 2, the grease composition of the present invention generated outgas in an amount that was from  $\frac{1}{2}$  to  $\frac{1}{3}$  of the amount generated by the Comparative Samples including base oils similar to the base oil of Morway et al. With the low amount of outgas generated by the grease composition of the present invention, the occurrence of an erroneous operation, even during operation of a hard disk having a high density memory element, is greatly reduced.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: \_\_\_\_\_

8. FEB. 2002



Motoharu AKIDAMA